

# Significant Event System Tutorial: DAQ Operations

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# SES Tutorial Outline

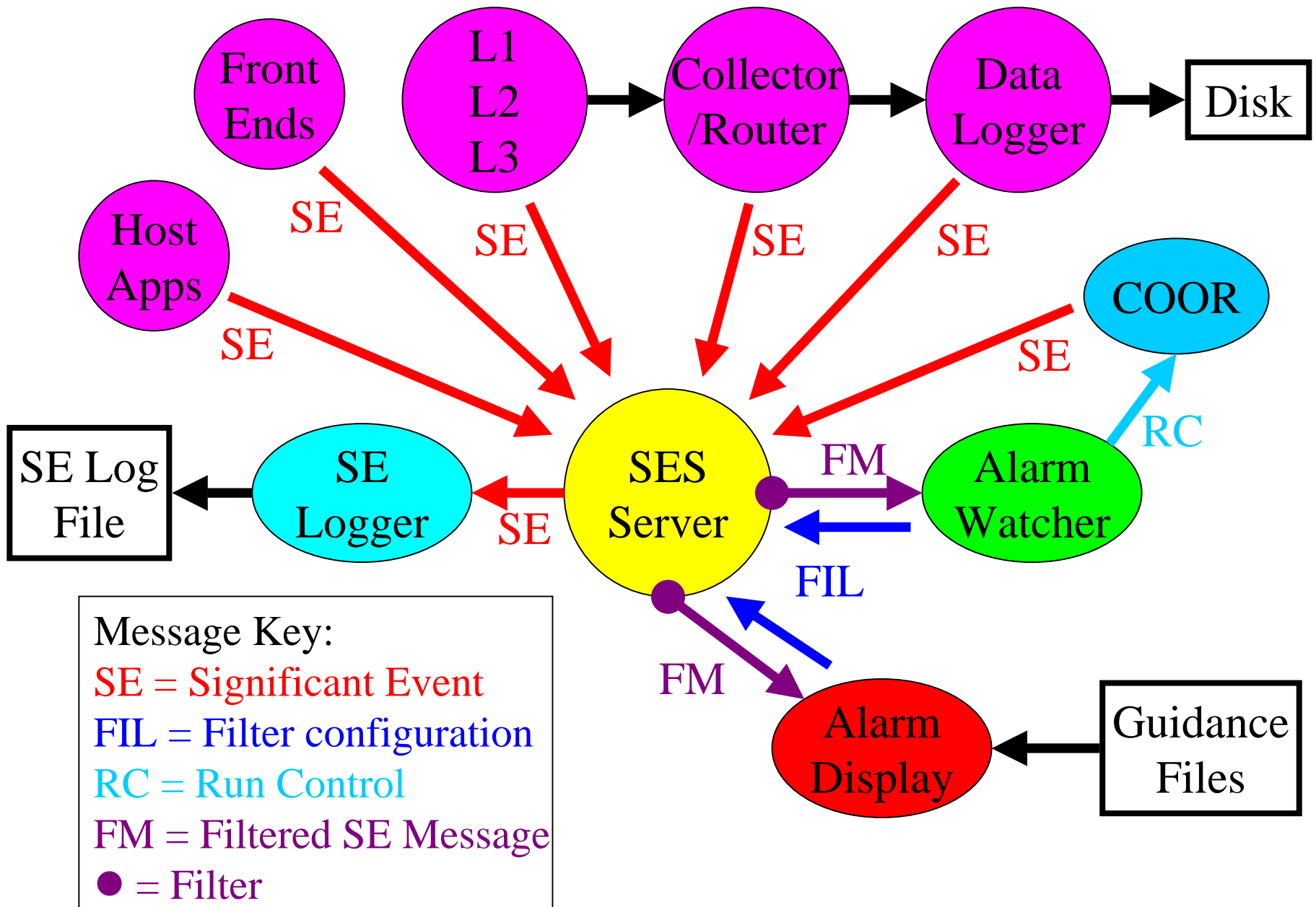
- ◆ Purpose – the role of the SES
- ◆ Overview – SES system architecture
- ◆ Shift operations – alarm display
- ◆ Core applications – server, alarm watcher, logger
- ◆ Operation – starting, stopping, and status



# Goals

- ◆ Monitor the health of the DZero online system
- ◆ During detector operations produce, distribute, and display events which are significant to the experiment
  - Alarm conditions
  - DAQ state transitions from COOR
- ◆ Archive SE messages for later review
  - Look for trends when diagnosing equipment issues
  - In run I the detectors state was checked for all top event candidates to insure the events were not artifacts of a detector problem





# Functionality

## ◆ Sender Clients

- Identify bad states
- Send alarms

## ◆ Server

- Maintains the current state
- Supplies the state to clients on request

## ◆ Logger

- Writes all SE messages to files

## ◆ Alarm watcher

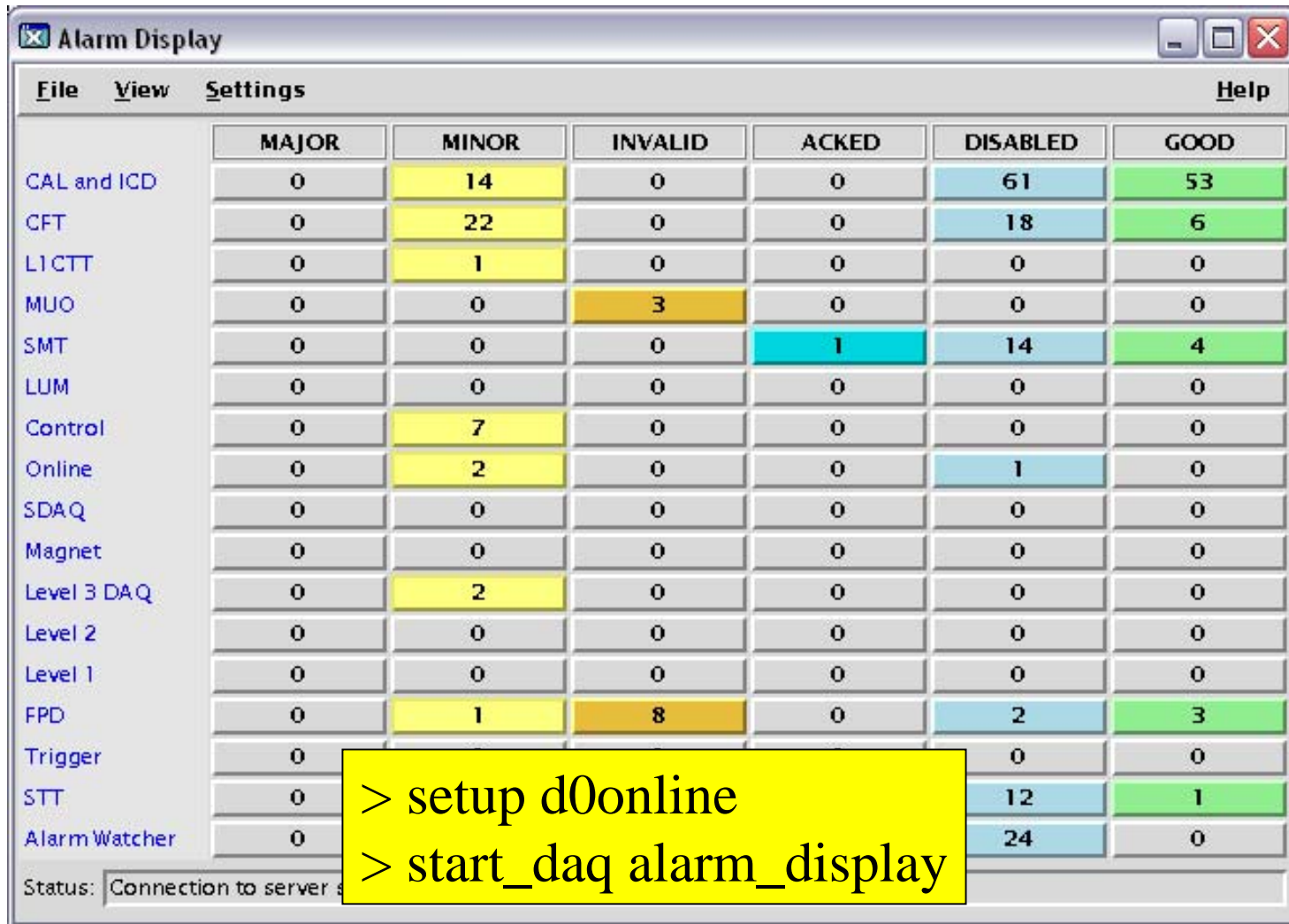
- Detects alarms that should pause runs
- Sends run pause commands to COOR

## ◆ Alarm display

- Shows the current state to the user
- Access guidance to assist in resolving an alarm condition



# Alarm Display



The screenshot shows a window titled "Alarm Display" with a menu bar (File, View, Settings, Help) and a table of alarm counts. The table has columns for MAJOR, MINOR, INVALID, ACKED, DISABLED, and GOOD. The rows list various components: CAL and ICD, CFT, L1 CTT, MUO, SMT, LUM, Control, Online, SDAQ, Magnet, Level 3 DAQ, Level 2, Level 1, FPD, Trigger, STT, and Alarm Watcher. A yellow box is overlaid on the bottom right of the table, containing the commands: > setup d0online and > start\_daq alarm\_display. The status bar at the bottom left shows "Status: Connection to server s".

	MAJOR	MINOR	INVALID	ACKED	DISABLED	GOOD
CAL and ICD	0	14	0	0	61	53
CFT	0	22	0	0	18	6
L1 CTT	0	1	0	0	0	0
MUO	0	0	3	0	0	0
SMT	0	0	0	1	14	4
LUM	0	0	0	0	0	0
Control	0	7	0	0	0	0
Online	0	2	0	0	1	0
SDAQ	0	0	0	0	0	0
Magnet	0	0	0	0	0	0
Level 3 DAQ	0	2	0	0	0	0
Level 2	0	0	0	0	0	0
Level 1	0	0	0	0	0	0
FPD	0	1	8	0	2	3
Trigger	0				0	0
STT	0				12	1
Alarm Watcher	0				24	0

> setup d0online  
> start\_daq alarm\_display

Status: Connection to server s



Alarm Display

File View Settings Help

	MAJOR	MINOR	INVALID	ACKED	DISABLED	GOOD
CAL and ICD	0	14				
CFT	0	22				
L1 CTT	0	1				
MUO	0	0				
SMT	0	0				
LUM	0	0				
Control	0	7				
Online	0	2				
SDAQ	0	0				
Magnet	0	0	0	0	0	0
Level 3 DAQ	0	2	0	0	0	0
Level 2	0	0	0	0	0	0
Level 1	0	0	0	0	0	0
FPD	0	1	8	0	2	3
Trigger	0	0	0	0	0	0
STT	0	42	0	0	12	1

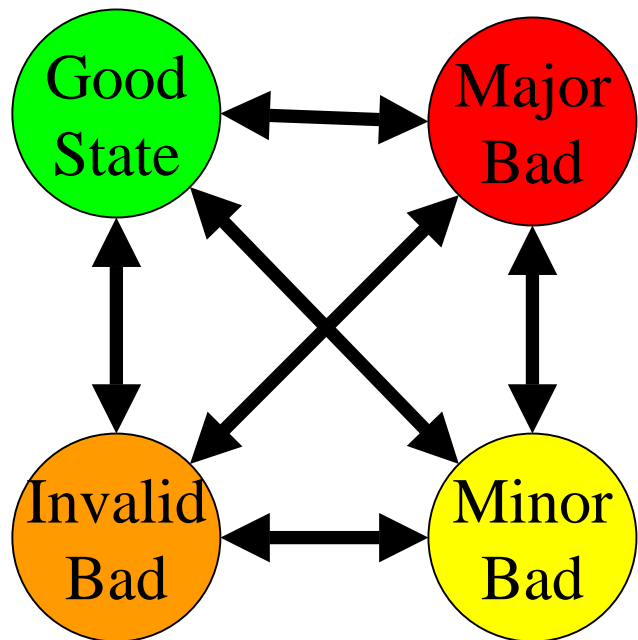
Four alarm severity levels:

- Major – fix the problem
- Minor – monitor the situation
- Invalid – read or write error
- Good – problem repaired

- Each button is labeled with a value that reflects the number of alarms of a severity that pass the filter for that row
- Each row has a different filter
- Alarms that pass multiple filters appear in multiple rows



Alarm Display						
File View Settings Help						
	MAJOR	MINOR	INVALID	ACKED	DISABLED	GOOD
CAL and ICD	0	14	0	0	61	53
CFT	0	22	0	0	18	6
L1 CTT	0	1	0	0	0	0
MUO	0	0	3	0	0	0
SMT	0	0	0	1	14	4
LUM	0	0	0	0	0	0
Control	0	7	0	0	0	0



### Alarm severity transitions

- A device starts in the good state (not listed on the display)
- A bad alarm is in one of the three severity levels
- Transitions from the bad severities to good can occur at any point
- As can transitions between severities



## Default configuration file, /online/config/ses/ad.config

**CAL and ICD**

- CFT
- L1CTT
- MUO
- SMT
- LUM
- Control
- Online
- SDAQ
- Magnet
- Level 3 DAQ
- Level 2
- Level 1
- FPD
- Trigger
- STT
- Alarm Watcher
- Status:

```
addRow('CAL and ICD', "(contains(det, 'CAL') or contains(det, 'ICD')) ...")
addRow('CFT', "contains(det, 'CFT')")
addRow('L1CTT', "contains(det, 'CTT')")
addRow('MUO', "contains(det, 'MUO')")
addRow('SMT', "contains(det, 'SMT')")
addRow('LUM', "contains(det, 'LUM')")
addRow('Control', "contains(det, 'CTL')")
addRow('Online', "contains(det, 'ONL') and not contains(devtype, 'SDAQ')")
addRow('SDAQ', "contains(devtype, 'SDAQ')")
addRow('Magnet', "contains(devtype, 'MAG')")
addRow('Level 3 DAQ', "contains(name, 'L3DAQ')")
addRow('Level 2', "contains(det, 'L2')")
addRow('Level 1', "contains(det, 'L1') and not contains(det, 'FPD')")
addRow('FPD', "contains(det, 'FPD')")
addRow('Trigger', "contains(det, 'TRG') or contains(det, 'TFW')")
addRow('STT', "contains(det, 'STT')")
addRow('Alarm Watcher', "contains(mtype, 'alarm') and (priority > 100)")
```

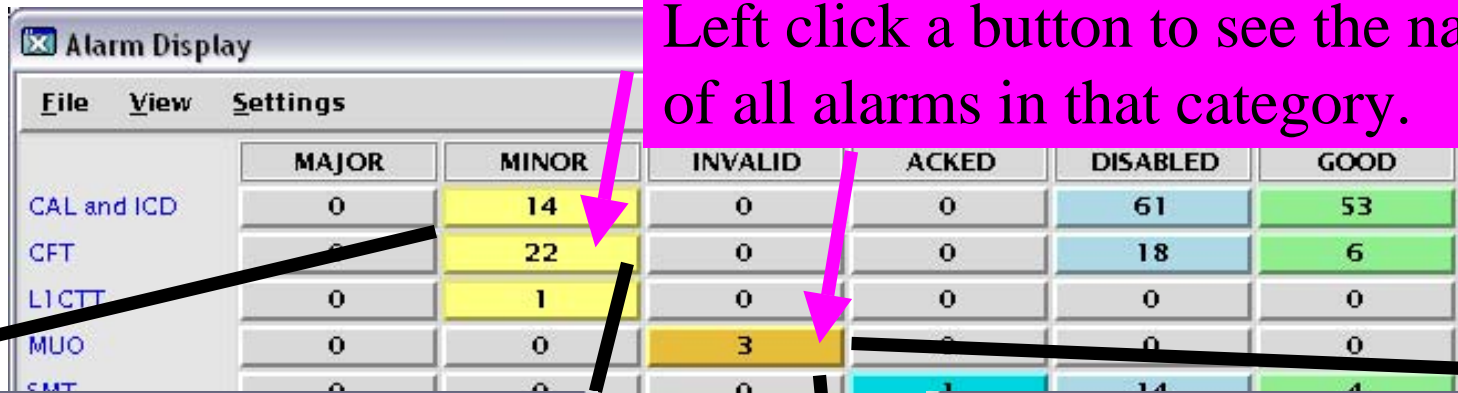
**An alarm display configuration file contains the filter for each row.**

**Identical to the alarm watcher filter.**

**Detector groups can generate a customized alarm display by creating a detector specific configuration file.**

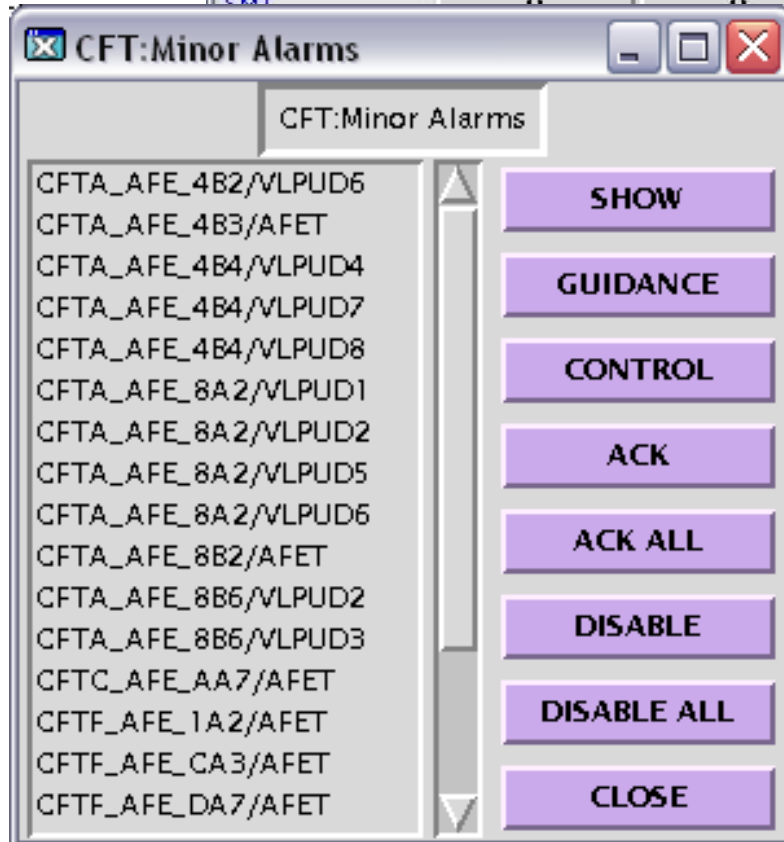


Left click a button to see the names of all alarms in that category.



The Alarm Display window shows a table with columns: MAJOR, MINOR, INVALID, ACKED, DISABLED, and GOOD. The rows represent different alarm categories: CAL and ICD, CFT, LI CTT, MUO, and SMT. The MINOR column for CFT has a value of 22, and the INVALID column for MUO has a value of 3. Arrows point from these values to the corresponding 'CFT:Minor Alarms' and 'MUO:Invalid Alarms' windows.

	MAJOR	MINOR	INVALID	ACKED	DISABLED	GOOD
CAL and ICD	0	14	0	0	61	53
CFT	0	22	0	0	18	6
LI CTT	0	1	0	0	0	0
MUO	0	0	3	0	0	0
SMT	0	0	0	0	14	4

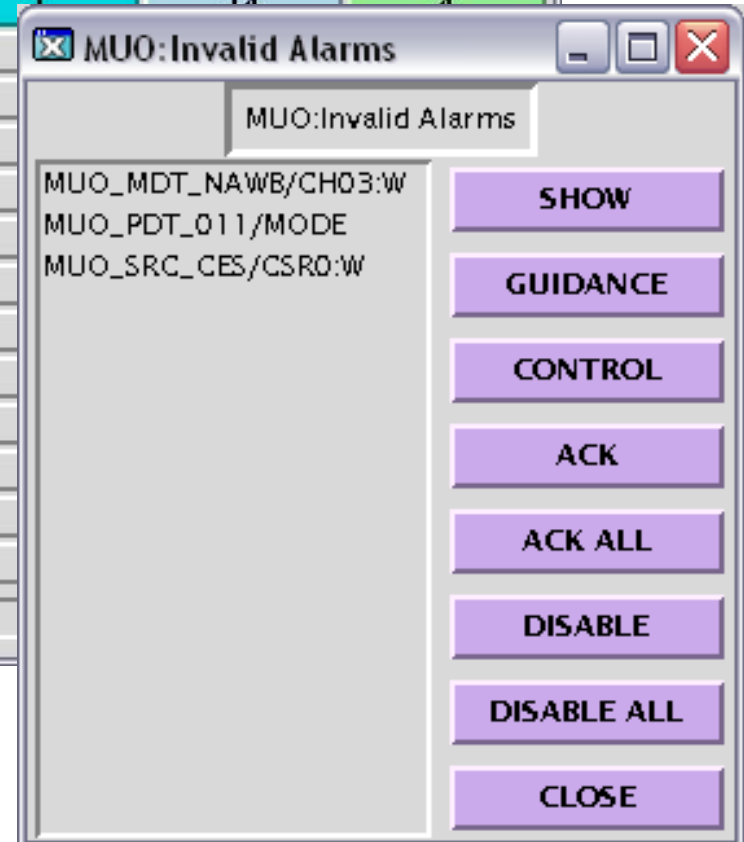


The CFT:Minor Alarms window displays a list of alarm names on the left and a set of action buttons on the right. The buttons include SHOW, GUIDANCE, CONTROL, ACK, ACK ALL, DISABLE, DISABLE ALL, and CLOSE.

**CFT:Minor Alarms**

- CFTA\_AFE\_4B2/VLPUD6
- CFTA\_AFE\_4B3/AFET
- CFTA\_AFE\_4B4/VLPUD4
- CFTA\_AFE\_4B4/VLPUD7
- CFTA\_AFE\_4B4/VLPUD8
- CFTA\_AFE\_8A2/VLPUD1
- CFTA\_AFE\_8A2/VLPUD2
- CFTA\_AFE\_8A2/VLPUD5
- CFTA\_AFE\_8A2/VLPUD6
- CFTA\_AFE\_8B2/AFET
- CFTA\_AFE\_8B6/VLPUD2
- CFTA\_AFE\_8B6/VLPUD3
- CFTC\_AFE\_AA7/AFET
- CFTF\_AFE\_1A2/AFET
- CFTF\_AFE\_CA3/AFET
- CFTF\_AFE\_DA7/AFET

**Buttons:** SHOW, GUIDANCE, CONTROL, ACK, ACK ALL, DISABLE, DISABLE ALL, CLOSE



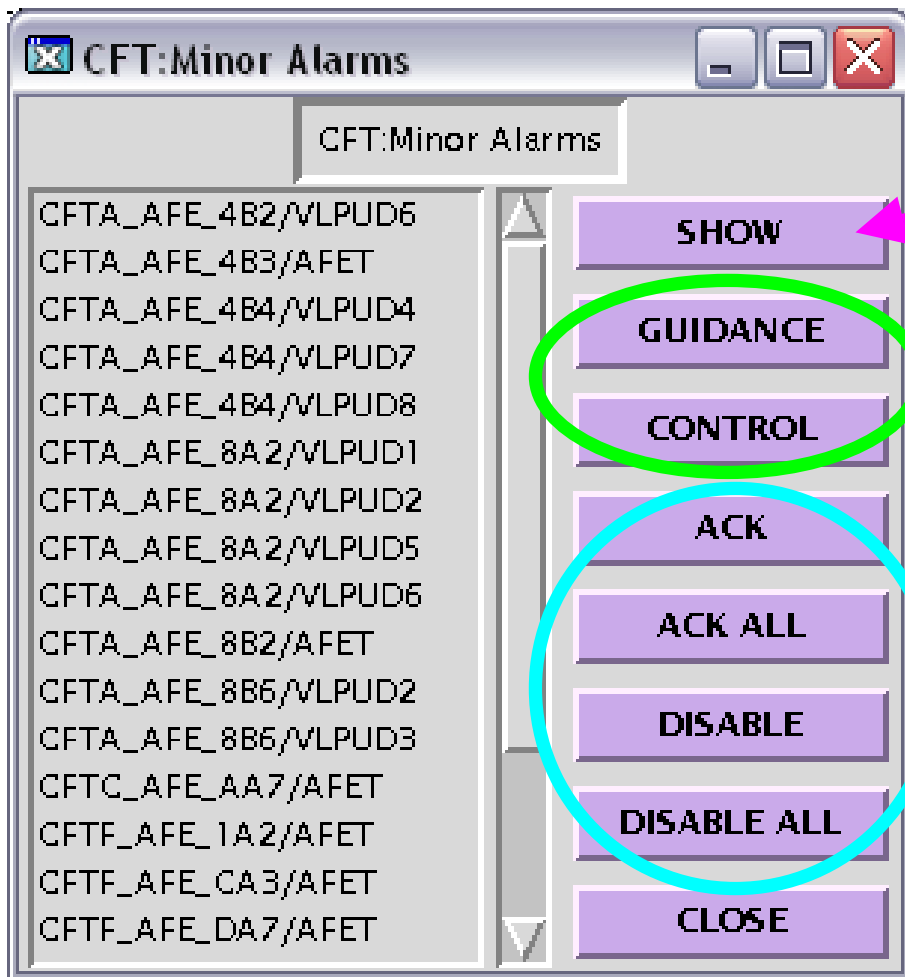
The MUO:Invalid Alarms window displays a list of alarm names on the left and a set of action buttons on the right. The buttons include SHOW, GUIDANCE, CONTROL, ACK, ACK ALL, DISABLE, DISABLE ALL, and CLOSE.

**MUO:Invalid Alarms**

- MUO\_MDT\_NAWB/CH03:W
- MUO\_PDT\_011/MODE
- MUO\_SRC\_CES/CSR0:W

**Buttons:** SHOW, GUIDANCE, CONTROL, ACK, ACK ALL, DISABLE, DISABLE ALL, CLOSE





Left click a name then click the show button or double click a name to see the single alarm display.

Get more information on the alarm

Alarms can be disabled or acknowledged from here.

- Alarm names identify the source of the alarm and must be unique.
- Alarms must follow the official DZero naming convention:  
<detector>\_<device type>\_<location>/<attribute>



Alarms in the good, acked, and disabled columns behave differently than alarms in bad columns.

- Aked indicates that a bad alarm has been seen by the shifter.
- A state transition causes the alarm to appear in the major, minor, invalid, or good column.

- There is a persistence mechanism for disabled alarms.
- The last alarm message sent will be stored in the disabled column independent of the alarms severity.
- Disabled alarms will not pause runs!!!

- An alarm transition from bad to good is stored for five minutes.
- Multiple alarms can be listed under one name.

[illegible]

# Single Alarm Display

**CTL\_PROC\_11/MEM:Control:Minor Alarms**

\*\*\*\*\* CTL\_PROC\_11/MEM \*\*\*\*\*

Alarm cause: High alarm  
Alarm value: 86.465053  
HiHi limit: 90.000000  
High limit: 60.000000  
Low limit: 0.000000  
LoLo limit: 0.000000

Message contents:  
version: v4  
utility: ef(6)  
timestamp: Thu Jan 29 10:23:42 2004  
message type: alarm  
name: CTL\_PROC\_11/MEM  
priority: 0  
host: d0olct11  
db entry: 0  
parent: none  
children: none  
transition: bad  
severity: minor  
alarm type: analog  
parameters: ai 4 86.465053 90.000000 60.000000 0.000000 0.000000

**Buttons:** CLOSE, ACK, DISABLE, CONTROL, GUIDANCE, COMMAND

**Callouts:**

- The name identifies the device in alarm.
- Explains the cause of the alarm.
- Shows the contents of the alarm message.



CTL\_PROC\_11/MEM:Control:Minor Alarms

\*\*\*\*\* CTL\_PROC\_11/MEM \*\*\*\*\*

Alarm cause: High alarm  
Alarm value: 86.465053  
HiHi limit: 90.000000  
High limit: 60.000000  
Low limit : 0.000000  
LoLo limit: 0.000000

Message contents:  
version: v4  
utility: ef(6)  
timestamp: Thu Jan 29 10:23:42 2004

parent: none  
children: none  
transition: bad  
severity: minor  
alarm type: analog  
parameters: ai 4 86.465053 90.000000 60.000000 0.000000 0.000000

•Acknowledge this alarm  
•Unack for an alarm in the acked column

Issue a command stored in the hardware database.

Display information on resolving the alarm condition.

CLOSE ACK DISABLE CONTROL GUIDANCE COMMAND

Disable this alarm.

Look at the current values.



# Current Control Values

Parameter Page / Jan 29 16:38:15

Reload Update Rate Quit

CTL_PROC_11/MEM.VAL	86.467081
CTL_PROC_11/MEM.SCAN	I/O Intr
CTL_PROC_11/MEM.ASND	1
CTL_PROC_11/MEM.HIHI	90.000000
CTL_PROC_11/MEM.HIGH	60.000000
CTL_PROC_11/MEM.LOW	0.000000
CTL_PROC_11/MEM.LOLO	0.000000
CTL_PROC_11/MEM.HHSV	MAJOR
CTL_PROC_11/MEM.HSV	MINOR
CTL_PROC_11/MEM.LSV	NO_ALARM
CTL_PROC_11/MEM.LLSV	NO_ALARM
CTL_PROC_11/MEM.SEVR	MINOR
CTL_PROC_11/MEM.STAT	HIGH

Current value

Send alarms?

Alarm limits

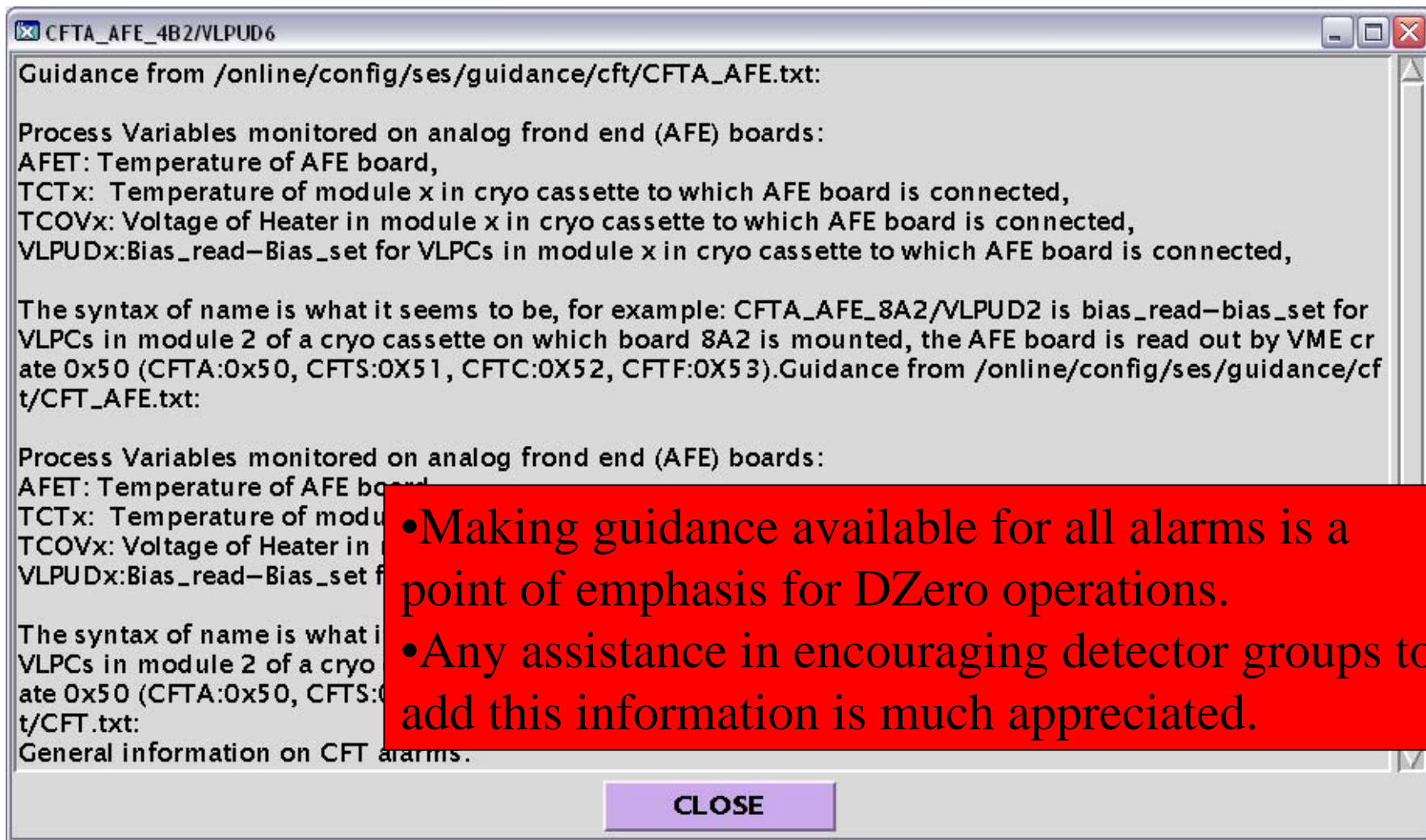
Severity for each limit

Current alarm state



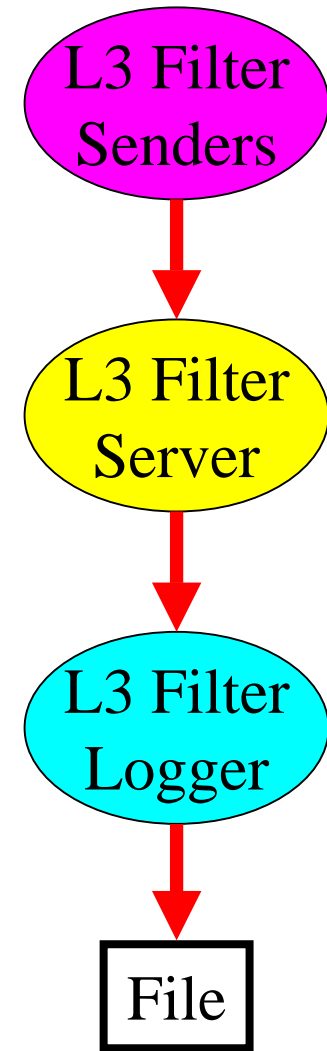
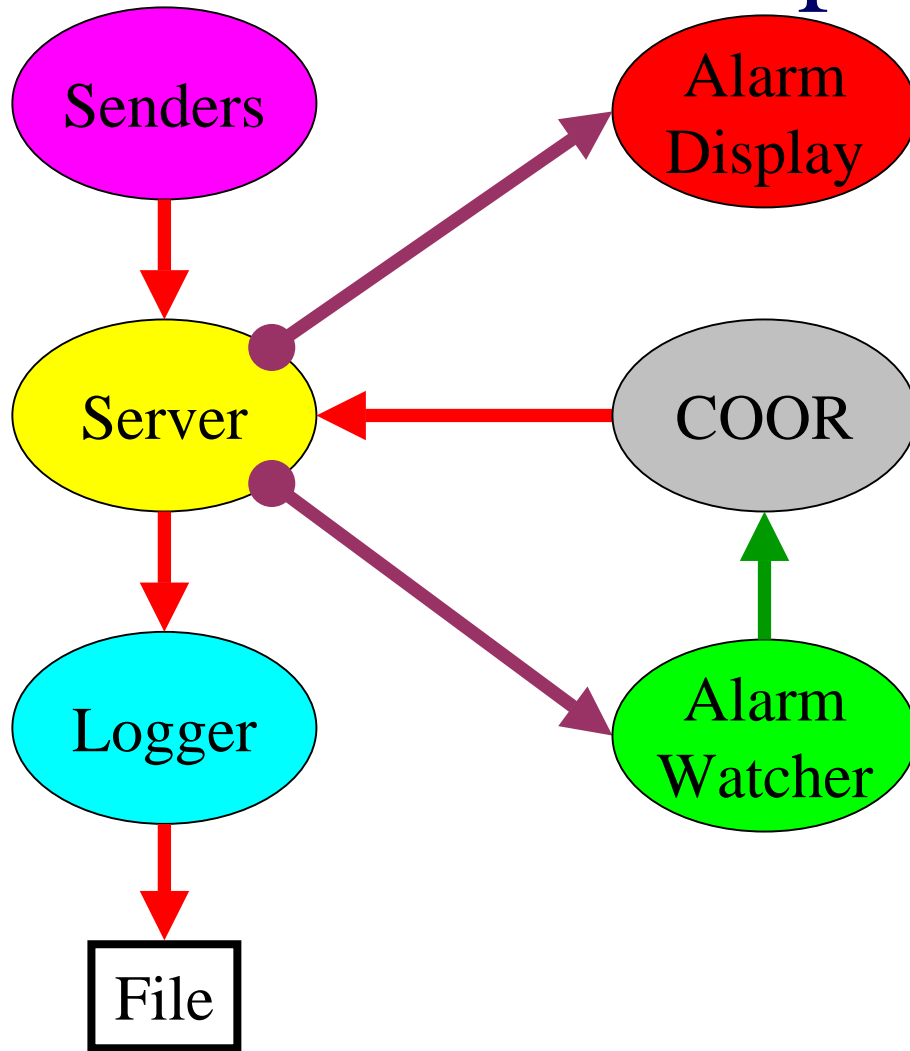


# Guidance





# Online Operations



## Why are there two servers in the SES?

- Errors in level 3 filters are fixed without outside intervention.
- The SES framework was a simple way to get level 3 filter errors written to a file for later review.
- There is a special level 3 message that is simply passed through the server to attached clients.

Alarm Display

COOR

Alarm Watcher

L3 Filter Senders

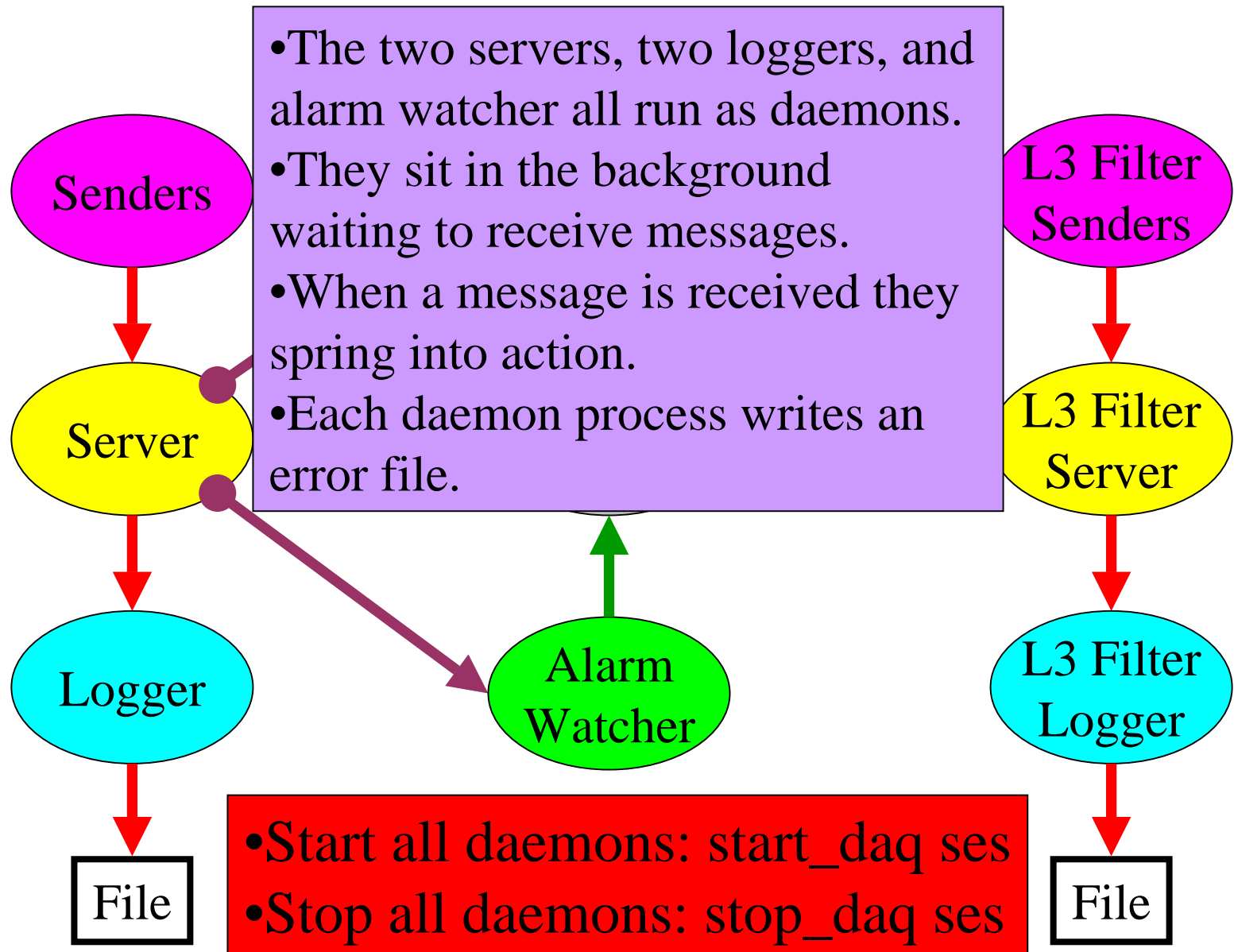
L3 Filter Server

L3 Filter Logger

File

The alarm display and watcher serve no purpose connected to the level 3 filter server.





Each daemon can be stopped and started individually.

- Start server:  
start\_daq ses\_server
- Stop server:  
stop\_daq ses\_server

Server

Logger

- Start logger:  
start\_daq ses\_logger
- Stop logger:  
stop\_daq ses\_logger

Alarm  
Display

- Start alarm watcher:  
start\_daq alarm\_watcher
- Stop alarm watcher:  
stop\_daq alarm\_watcher

Alarm  
Watcher

- Start L3 filter server:  
start\_daq ses\_l3\_server
- Stop L3 filter server:  
stop\_daq ses\_l3\_server

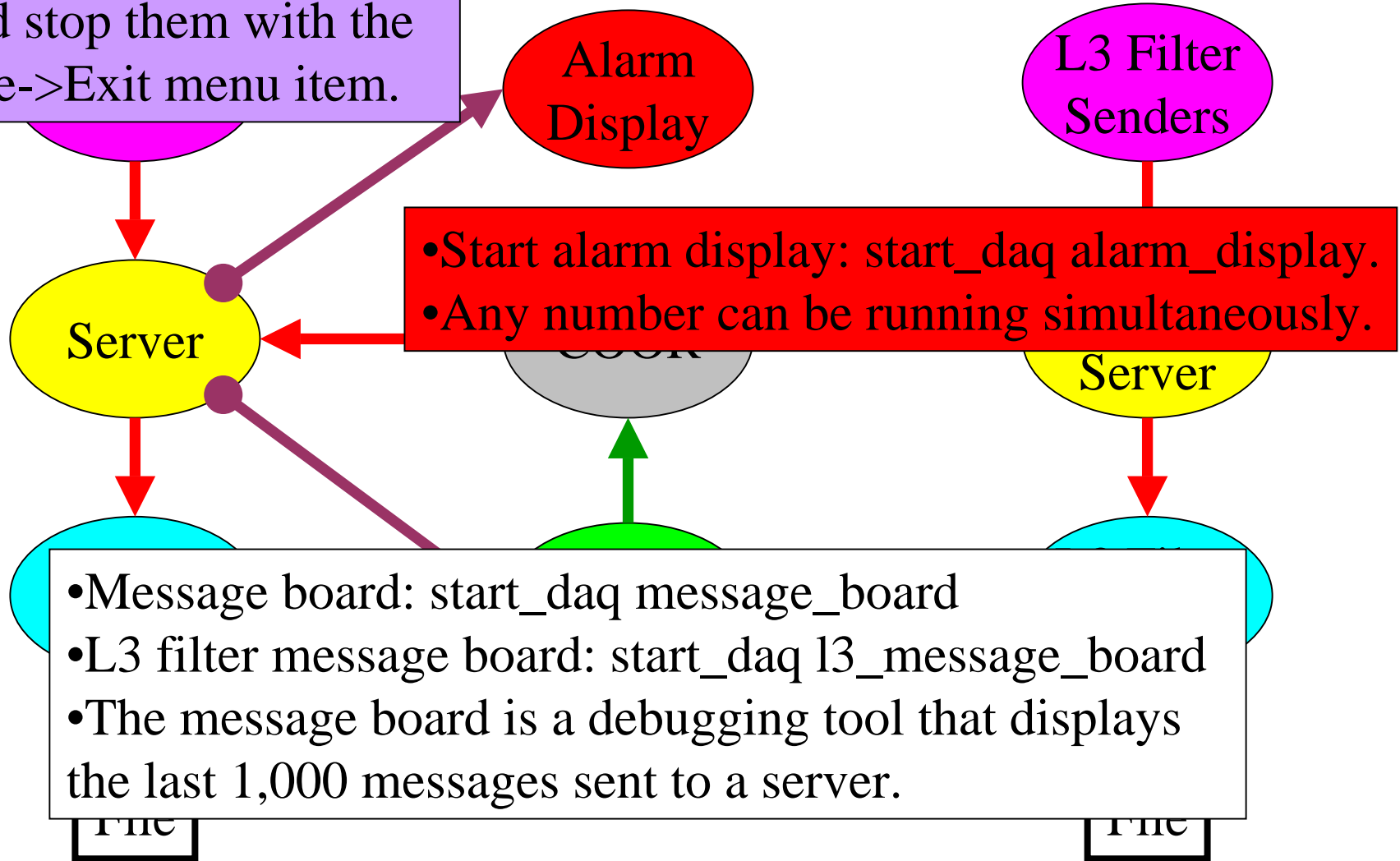
L3 Filter  
Server

L3 Filter  
Logger

- Start L3 filter logger: start\_daq ses\_l3\_logger
- Stop L3 filter logger: stop\_daq ses\_l3\_logger



Start the user interfaces with the start\_daq script and stop them with the File->Exit menu item.



System configuration is handled in  
/online/data/d0online/d0online\_names.py.

- SES\_SERVER\_ADDR="d0ol39.fnal.gov:52150
- SES\_DISABLE\_FILE="/online/config/ses/ses.disable
- The disable file keeps a record of disabled alarms for persistence.
- SES\_L3\_SERVER="d0ol39.fnal.gov:52245

Server

- SES\_ALARM\_WATCHER\_ADDR="d0olc.fnal.gov:52153
- SES\_AW\_CONFIG\_FILE="/online/config/ses/aw.config"

L3 Filter  
Server

Logger

Alarm  
Watcher

L3 Filter  
Logger

- SES\_LOGGER\_ADDR="d0olc.fnal.gov:52151
- SES\_L3LOGGER\_ADDR="d0olc.fnal.gov:52246
- Each logger occupies a port to prevent multiple instances from running.

File

File



New log files are opened when:

- The logger starts
- At midnight
- The server is restarted

- Date when the file was opened.
- YYYYMMDD-NNMMSSSTZ

alarm

L3 Filter

-rw-r--r--	1	d0run	d0_prod	2688616	Jan 28 23:59	se_log.20040128-000000CST.gz
-rw-r--r--	1	d0run	d0_prod	3796569	Jan 29 10:22	se_log.20040129-000000CST.gz
-rw-r--r--	1	d0run	d0_prod	3796569	Jan 30 00:00	se_log.20040129-102321CST.gz
-rw-r--r--	1	d0run	d0_prod	97396837	Jan 31 00:00	se_log.20040130-000000CST
-rw-r--r--	1	d0run	d0_prod	201863729	Jan 31 23:59	se_log.20040131-000000CST
-rw-r--r--	1	d0run	d0_prod	87175211	Feb 1 23:59	se_log.20040131-235959CST
-rw-r--r--	1	d0run	d0_prod	79317890	Feb 2 23:59	se_log.20040202-000000CST
-rw-r--r--	1	d0run	d0_prod	47788150	Feb 3 14:42	se_log.20040203-000000CST

Logger

File

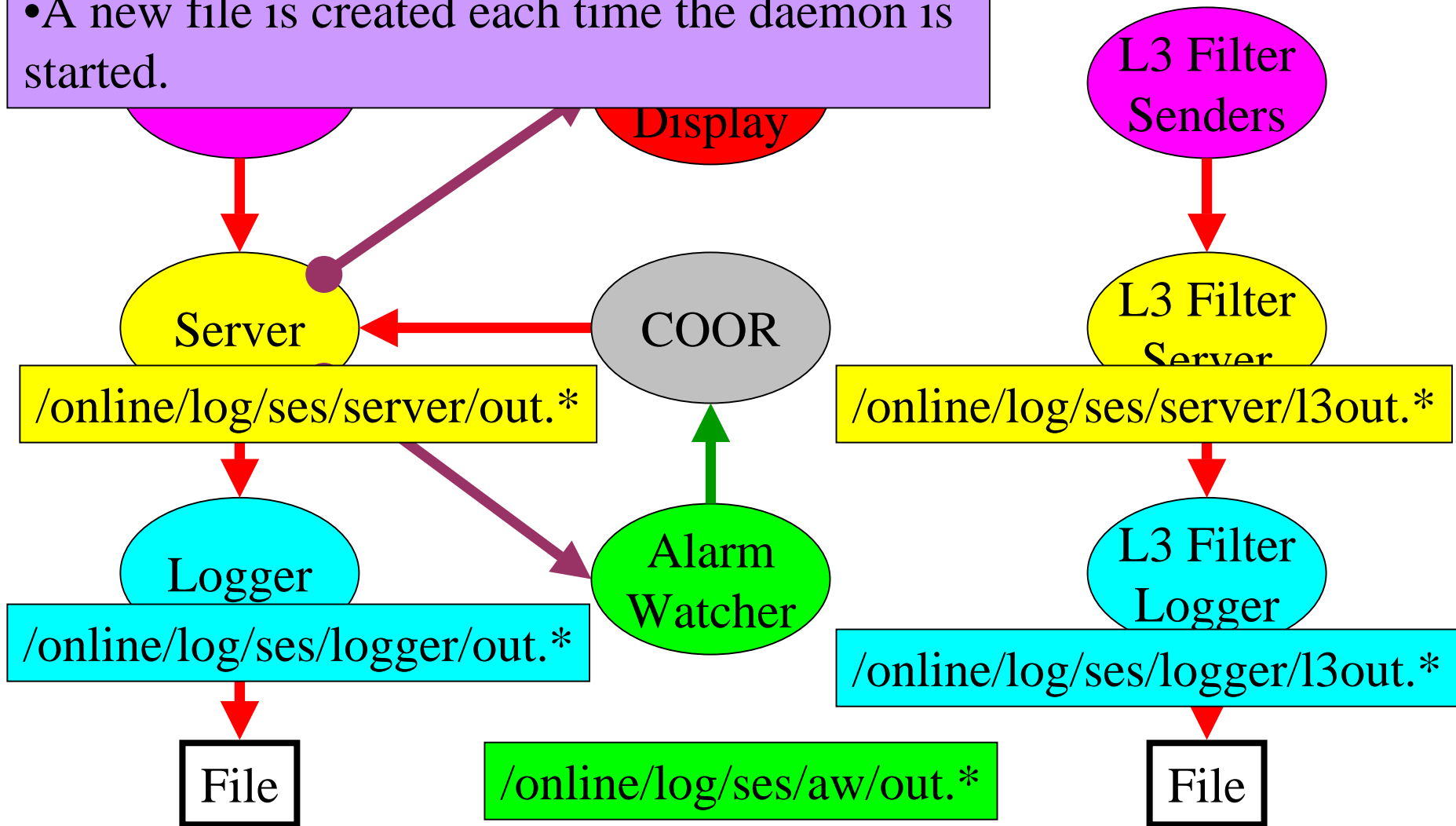
- Log files written by the logger are located in /online/log/ses.
- Log files written by the l3 logger are located in /online/log/ses/l3
- A cron job zip log files more than a few days old.

L3 Filter  
Logger

File



- All the daemons write information about their internal state to files to aid in debugging
- A new file is created each time the daemon is started.





# Manually Checking the Daemons

- ◆ Log into the computer specified in `d0online_names.py`
- ◆ View the process status with the `ps` command
- ◆ When starting each daemon all the data is passed via command line arguments
  - `-r` = port on which a server listens for connection requests
  - `-c` = configuration file
  - `-h` = server host
  - `-p` = server port
  - `-l` = log directory
  - `--coor` = COOR host and port



```
<d0ol39> ps auxwww | grep seserver
```

```
d0run  29841  0.0  3.6 849036 18720 ?    S   Jan29  0:00 python  
/online/products/SigEvtSys/onl04-05-00/NULL/py/seserver.py -r 52150 -c  
/online/config/ses/ses.disable
```

Server

```
d0run  31997  0.0  7.8 1036712 40084 ?    S   Jan23  0:00 python  
/online/products/SigEvtSys/onl04-05-00/NULL/py/seserver.py -r 52245
```

L3 Server

```
<d0olc> ps auxwww | grep selogger
```

```
d0run  612223 0.9  0.2 15.6M 6.6M ??    S   Jan 23  05:08:08 python  
/online/products/SigEvtSys/onl04-05-00/NULL/py/selogger.py -p 52150 -h  
d0ol39.fnal.gov -l /online/log/ses -r 52151
```

```
d0run  616384 0.2  0.2 16.3M 7.5M ??    S   Jan 23  05:57:13 python  
/online/products/SigEvtSys/onl04-05-00/NULL/py/selogger.py -p 52245 -h  
d0ol39.fnal.gov -l /online/log/ses/13 -r 52246
```

Logger

L3 Logger

```
<d0olc> ps auxwww | grep watcher
```

```
d0run  687585 0.0  0.1 14.2M 5.4M ??    S   Jan 29  21:02.30 python  
/online/products/SigEvtSys/onl04-05-00/NULL/py/sealarmwatcher.py -p 52150 -h  
d0ol39.fnal.gov -r 52153 -c /online/config/ses/aw.config --  
coor=d0olc.fnal.gov:52127 --online
```

Alarm Watcher

